Semester: V						
COMPUTATIONAL ADVANCED NUMERICAL METHODS (Theory) (Group B: Global Elective)						
Course Code	**:**	18G5B16		**CIE**	**:**	**100 Marks**
Credits: L:T:P	**:**	3:0:0		**SEE**	**:**	**100 Marks**
Total Hours	**:**	39L		**SEE Duration**	**:**	**3.00 Hours**

Course Learning Objectives: The students will be able to

1	Gain adequate exposure to learn alternative methods to solve algebraic and transcendental equations using suitable numerical techniques.
2	Use the concepts of interpolation techniques arising in various fields.
3	Solve initial value and boundary value problems which have great significance in engineering practice.
4	Apply the concepts of eigen value and eigen vector to obtain the critical values of various physical phenomena.
5	Demonstrate elementary programming language, implementation of algorithms and computer programs to solve mathematical problems.

Unit-I	**07 Hrs**
Algebraic and Transcendental Equations: Roots of equations in engineering practice - Fixed point iterative method, Aitken process, Muller method, Chebyshev method. Simulation using MATLAB.	
Unit – II	**07 Hrs**
Interpolation: Introduction to finite differences, Finite differences of a polynomial, Divided differences, Newton's divided difference interpolation formula, Hermite interpolation, Spline interpolation - linear, quadratic and cubic spline interpolation. Simulation using MATLAB.	
Unit –III	**08 Hrs**
Differential Equations I: Runge-Kutta and Runge-Kutta-Felhberg methods to solve differential equations, Boundary value problems (BVPs) - Rayleigh-Ritz method, Shooting method, Differential transform method to solve differential equations. Simulation using MATLAB.	
Unit –IV	**08 Hrs**
Differential Equations II: Solution of second order initial value problems - Runge-Kutta method, Milne method, Cubic spline method, Finite difference method for ordinary linear, Nonlinear differential equations, Simulation using MATLAB.	
Unit –V	**09 Hrs**
Eigen Value Problems: Eigen values and Eigen vectors, Power method, Inverse Power method, Bounds on Eigen values, Gershgorin circle theorem, Jacobi method for symmetric matrices, Given's method. Simulation using MATLAB.	

Course Outcomes: After completing the course, the students will be able to	
CO1:	Identify and interpret the fundamental aspects of different Mathematical concepts and corresponding computational techniques.
CO2:	Apply the knowledge and skills of computational techniques to solve different types of application problems.
CO3:	Analyze the physical problem and use appropriate method to solve numerically using computational techniques.
CO4:	Distinguish the overall mathematical knowledge gained to demonstrate and analyze the problems arising in engineering practice.

Reference Books	
1	Numerical methods for scientific and engineering computation, M. K. Jain, S. R. K. Iyengar and R. K. Jain, 6th Edition, 2012, New Age International Publishers, ISBN-13: 978-81-224-2001-2.
2	Numerical Analysis, Richard L. Burden and J. Douglas Faires, 9th Edition, 2012, Cengage Learning, ISBN-13: 978-81-315-1654-6.
3	Introductory Methods of Numerical Analysis, S. S. Sastry, 4th Edition, 2011, PHI Learning Private Ltd., ISBN: 978-81-203-2761-0.
4	Numerical Methods for Engineers, Steven C. Chapra, Raymond P. Canale, 5th Edition, 2011, Tata Mcgraw Hill, ISBN-10: 0-07-063416-5.

Continuous Internal Evaluation (CIE); Theory (100 Marks)
CIE is executed by the way of Tests (T), Quizzes (Q),) and Experiential Learning (EL). Three tests are conducted for 50 marks each and the sum of the marks scored from three tests is reduced to 50. Minimum of three quizzes are conducted and each quiz is evaluated for 10 marks adding up to 30 marks. All quizzes are conducted online. Faculty may adopt innovative methods for conducting quizzes effectively. The number of quizzes may be more than three also. The marks component for experiential learning is 20.
Total CIE is 50 (T) +30 (Q) +20 (EL) = 100 Marks.

Semester End Evaluation (SEE); Theory (100 Marks)
SEE for 100 marks is executed by means of an examination. The Question paper for the course contains two parts, Part – A and Part – B. Part – A consists of objective type questions for 20 marks covering the complete syllabus. Part – B consists of five main questions, one from each unit for 16 marks adding up to 80 marks. Each main question may have sub questions. The question from Units I, IV and V have no internal choice. Units II and III have internal choice in which both questions cover entire unit having same complexity in terms of COs and Bloom's taxonomy level.

CO-PO Mapping												
CO/PO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	2	-	1	-	-	-	-	-	-	-	2
CO2	3	2	1	-	-	-	-	-	-	-	-	2
CO3	2	3	2	2	-	-	-	-	-	-	-	1
CO4	3	3	1	2	1	-	-	-	-	-	-	3

High-3: Medium-2: Low-1